# Decision support tools for farm-level fertilizer recommendation in Ethiopia

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**Workshop and Exhibition on Promoting Productivity and Market Access Technologies and Approaches to Improve Farm Income and Livelihoods in Ethiopia: Lessons from Action Research Projects, ILRI, Addis Ababa, 8-9 December 2016**

# Background

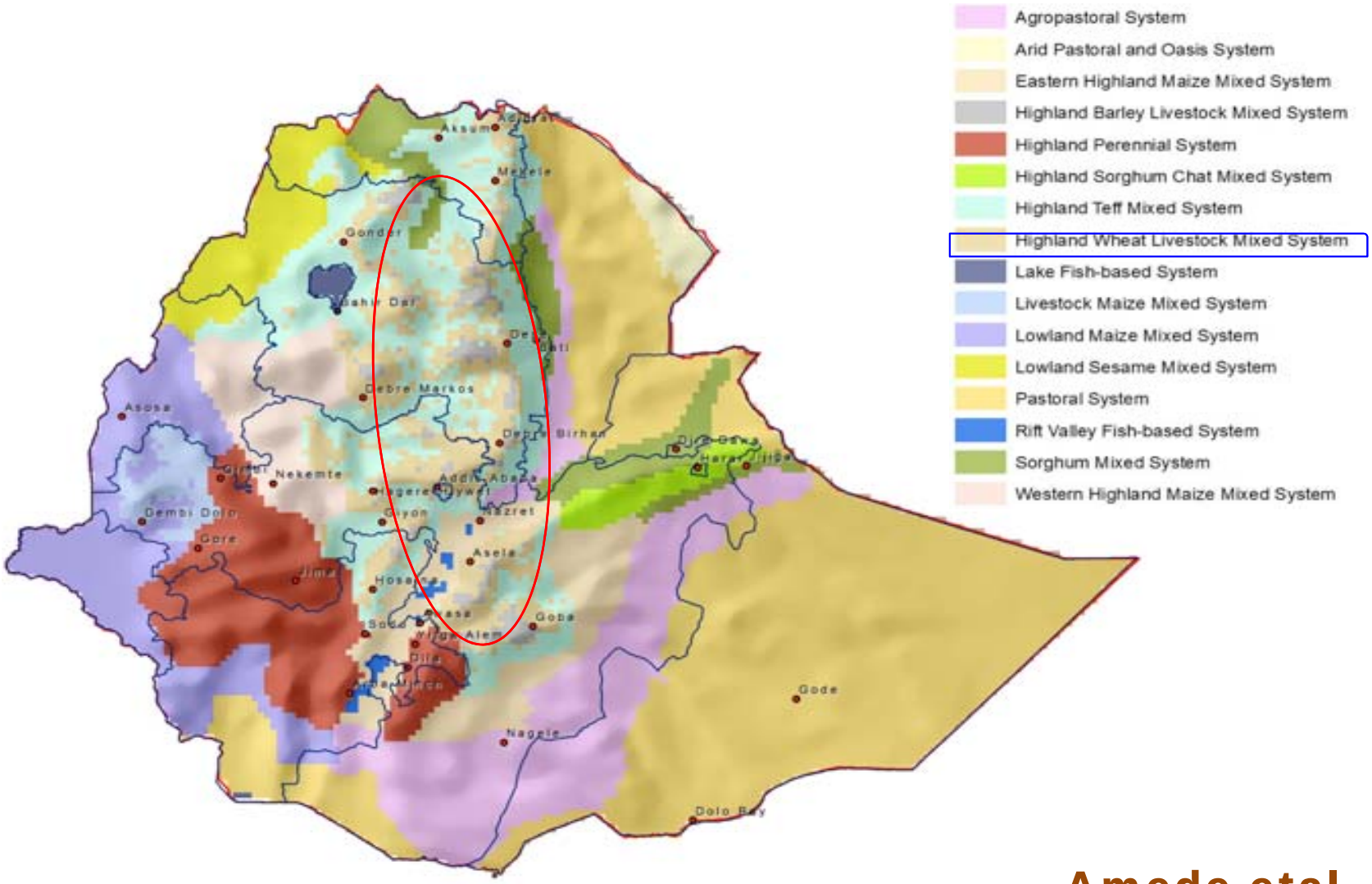
- Ethiopian agriculture is very **old, traditional**
- **Low-input, Low-out put**
- Characterized by **Nutrient mining**
  - Soil erosion for centuries
  - Limited input application (18 kg ha-1)
  - Limited nutrient recycling (e.g manure for cooking, plastering)
- **Diverse** in altitude, agroecology, food habit
- **Agronomical Inefficient**, low productivity per unit of land, labour, water

# Sustainable Intensification

## Satisfying immediate and growing future needs

- **Increased use of inputs** (fertilizers, improved seeds, pesticides)
- **Input Efficiency:** More food, More money per unit of capital/ input (e.g. fertilizer); $$$
- Value addition: From subsistence to market-oriented, nutrition-rich systems
- Mechanization: tools enhancing production efficiency
- Market incentives
- Policy support

# Farming systems of Ethiopia

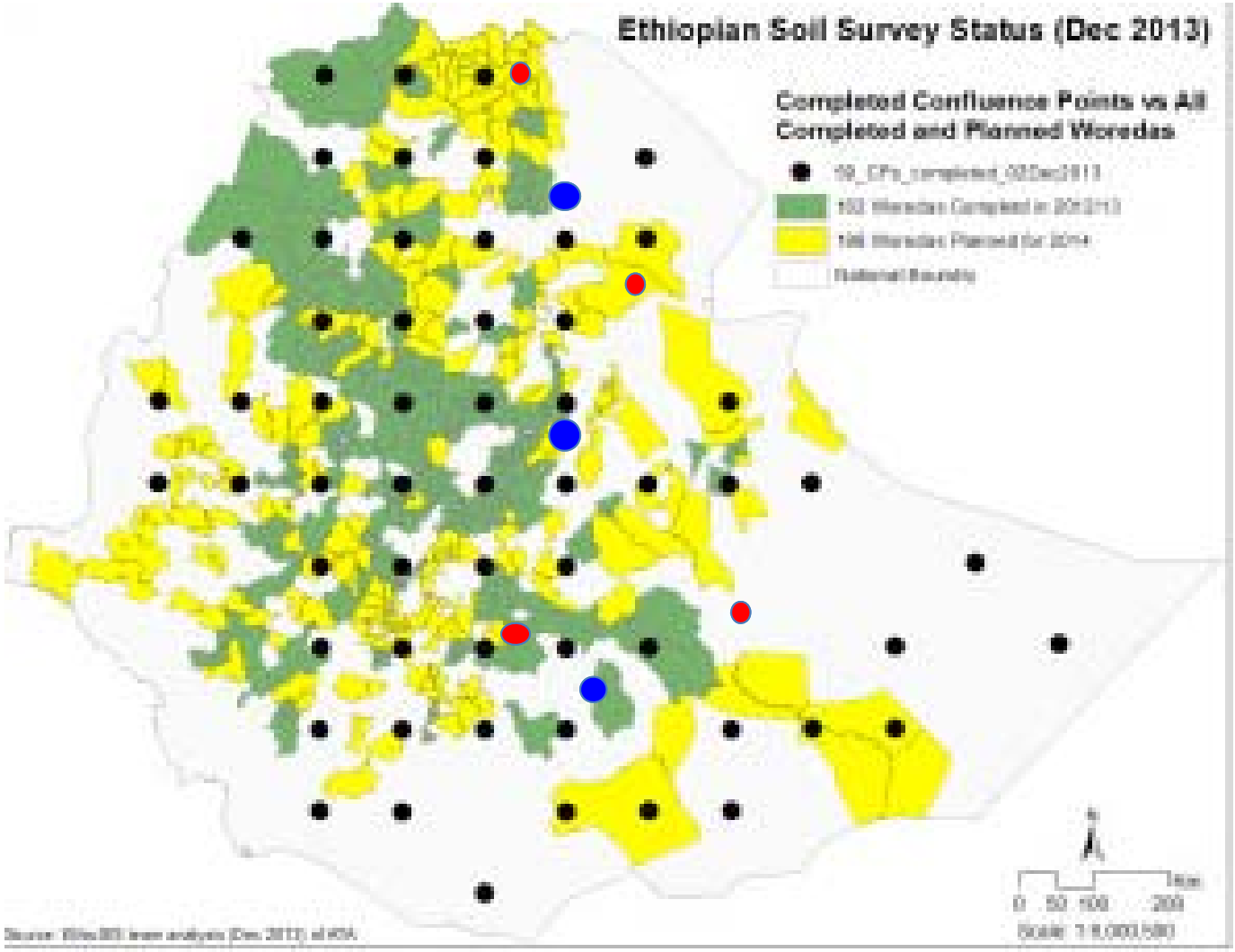



**Amede etal., 2015**

# Appreciating diversity; Wheat systems


# ATA did a very good job in promoting site specific fertilizer recommendation:

## Confluence points and our sites



# Our treatments in Mehoni (Optimal nutrient applications)

- NP (90/45)
- NPK (90/45/61)
- NPKS (90/45/61/63)
- NPKSZn (90/45/61/63/10
- Minimum application (30% recommended NP)
- Farmer's fields (control)

# Fertilizer combination and rates used for the onfarm experiments

| Treatment level | Fertilizer combination | Urea (kg/ha) | DAP (kg/ha) | Potassium Nitrate (kg/ha) | Potassium Sulphate (kg/ha) | Zinc Sulphate (kg/ha) |
|---|---|---|---|---|---|---|
| **T1** | N, P | 151 | 161 | 0 | 0 | 0 |
| **T2** | N,P,K | 117 | 161 | 162.5 | 0 | 0 |
| **T3** | N,P,K,S | 151 | 161 | 0 | 163 | 0 |
| **T4** | N,P,K,S,Z | 151 | 161 | 0 | 163 | 24.5 |
| **T5** | Control (33% NP) | 49.8 | 53.1 | 0 | 0 | 0 |

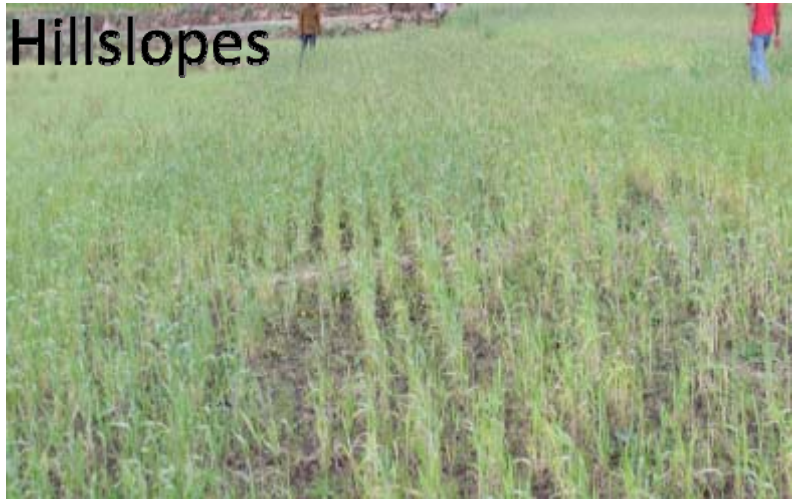
# Identifying Nutrient Management Zones

- ✓ Fields are a mosaic of habitats, each having unique biophysical characteristics that influence soil properties and crop yields.
- ✓ The effectiveness of matching fertilizer types to soil fertility problems rests on the ability to identify limiting factors, characterize sites, and develop appropriate recommendations.
- ✓ Approaches for identifying nutrient management zones require collection and interpretation of spatial data (yield, elevation, RS, electrical conductivity, soil nutrient maps, and Farmers' classification criteria).

# Nutrient Zonation within the Wheat systems

**Our research (500 farmers fields) show three types of responses to application of various fertilizer combinations**

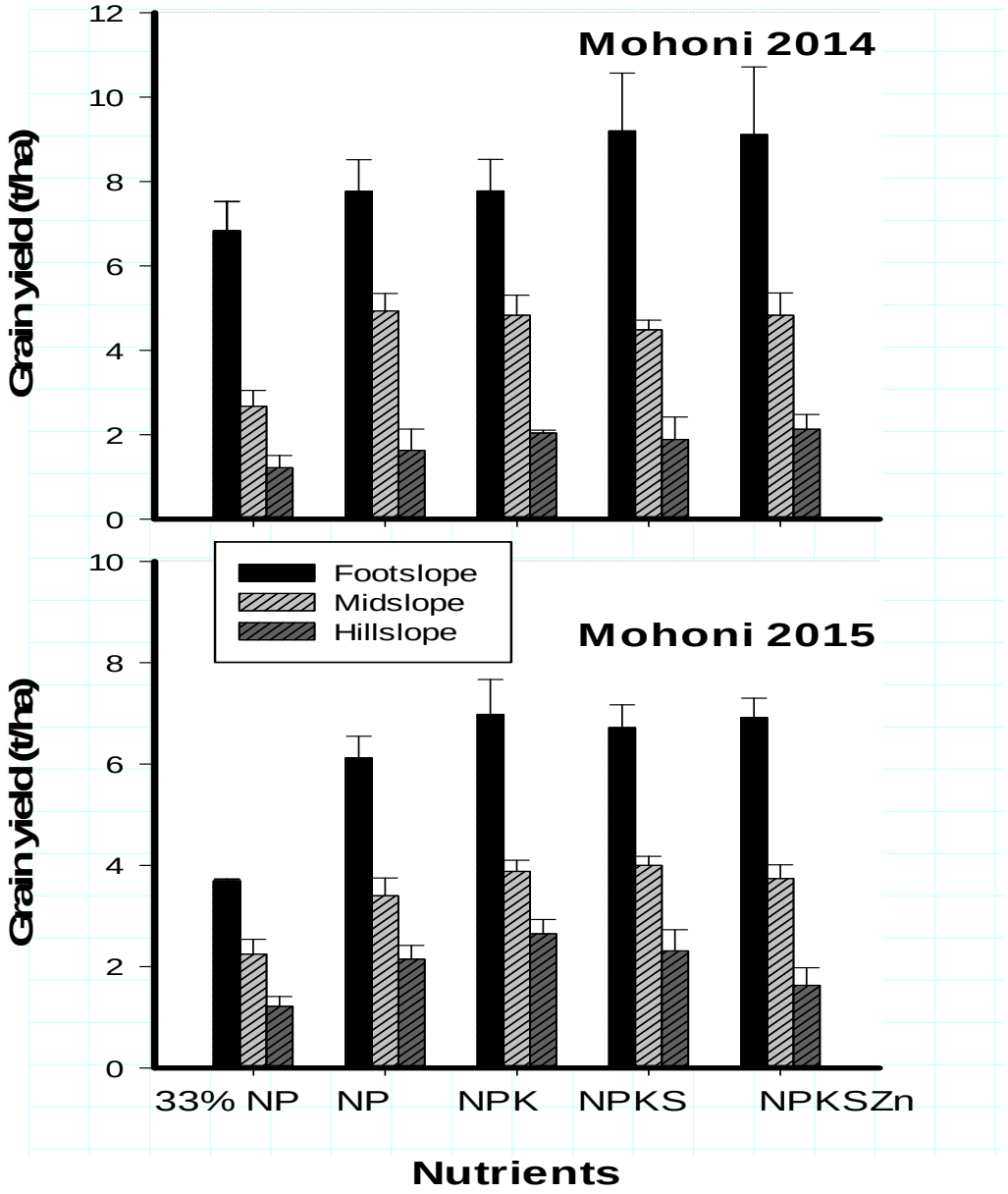





## Enda-Mehoni

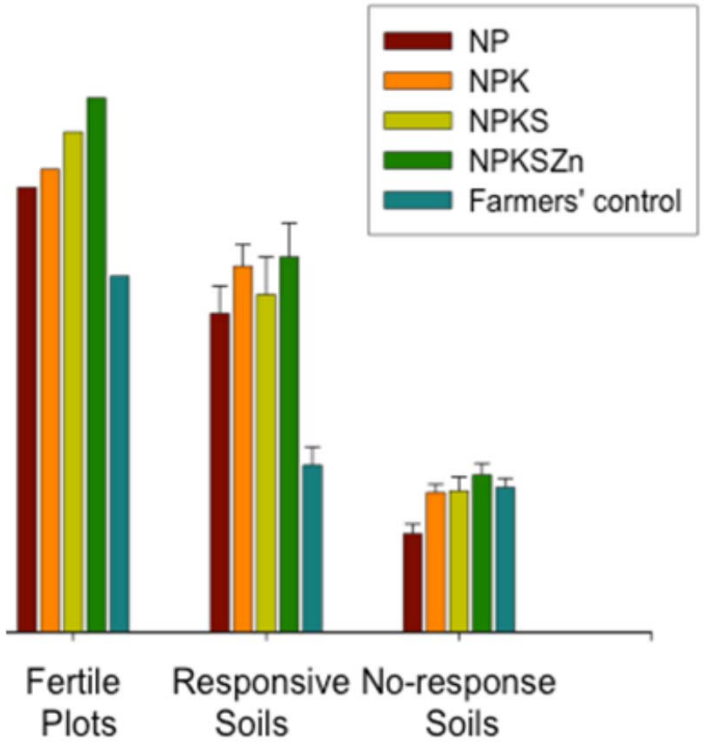
- **Foot slopes**: Very Good Crop and responded to fertilizer application;
- **Midslopes**: Crop is doing well and significantly responded to fertilizer application (300%);
- **Hillslope:** Very Bad crop Regardless of high rates of fertilizer application

# Wheat Grain yield under various Landscape positions in Mohoni



# Bosena District





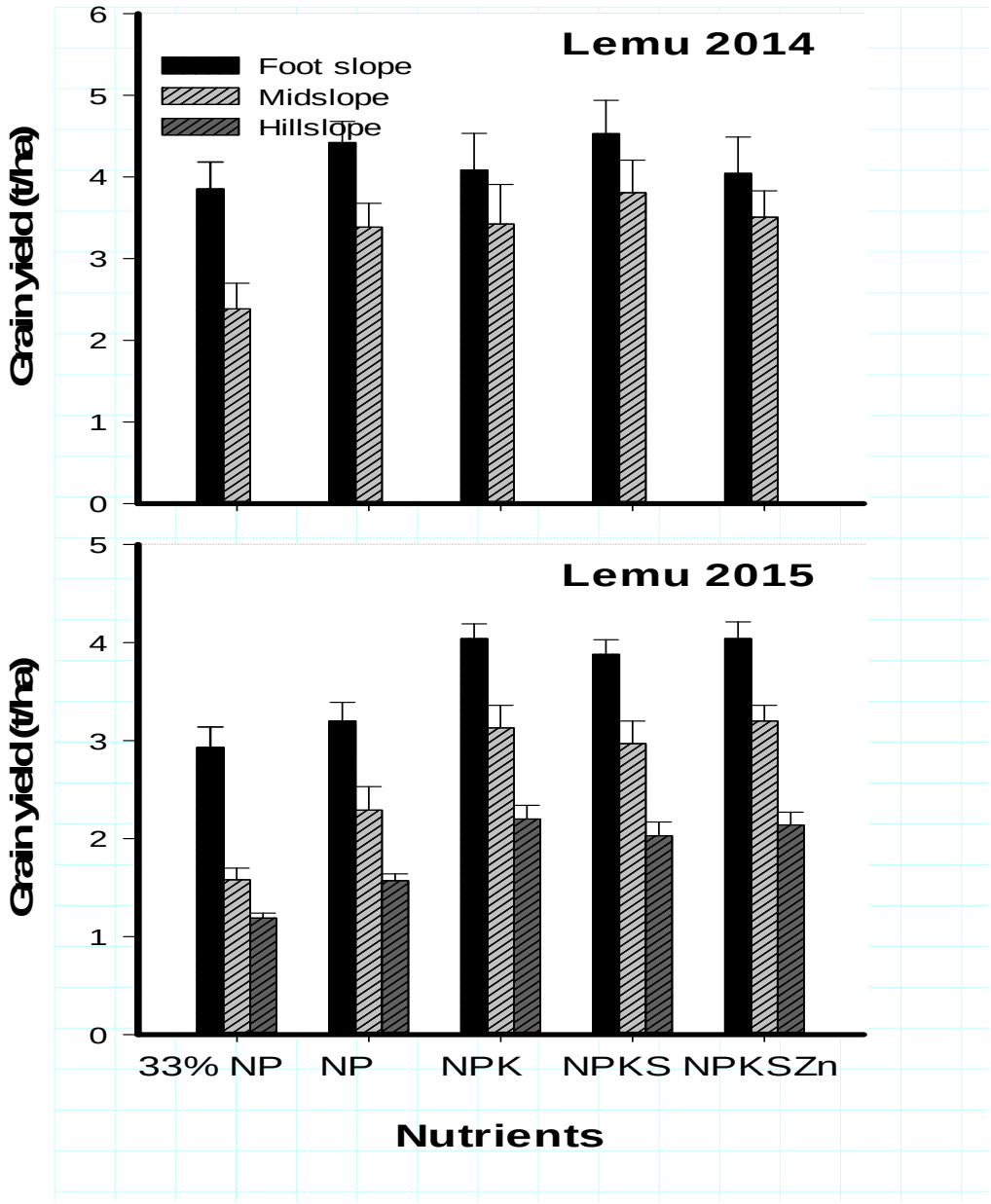




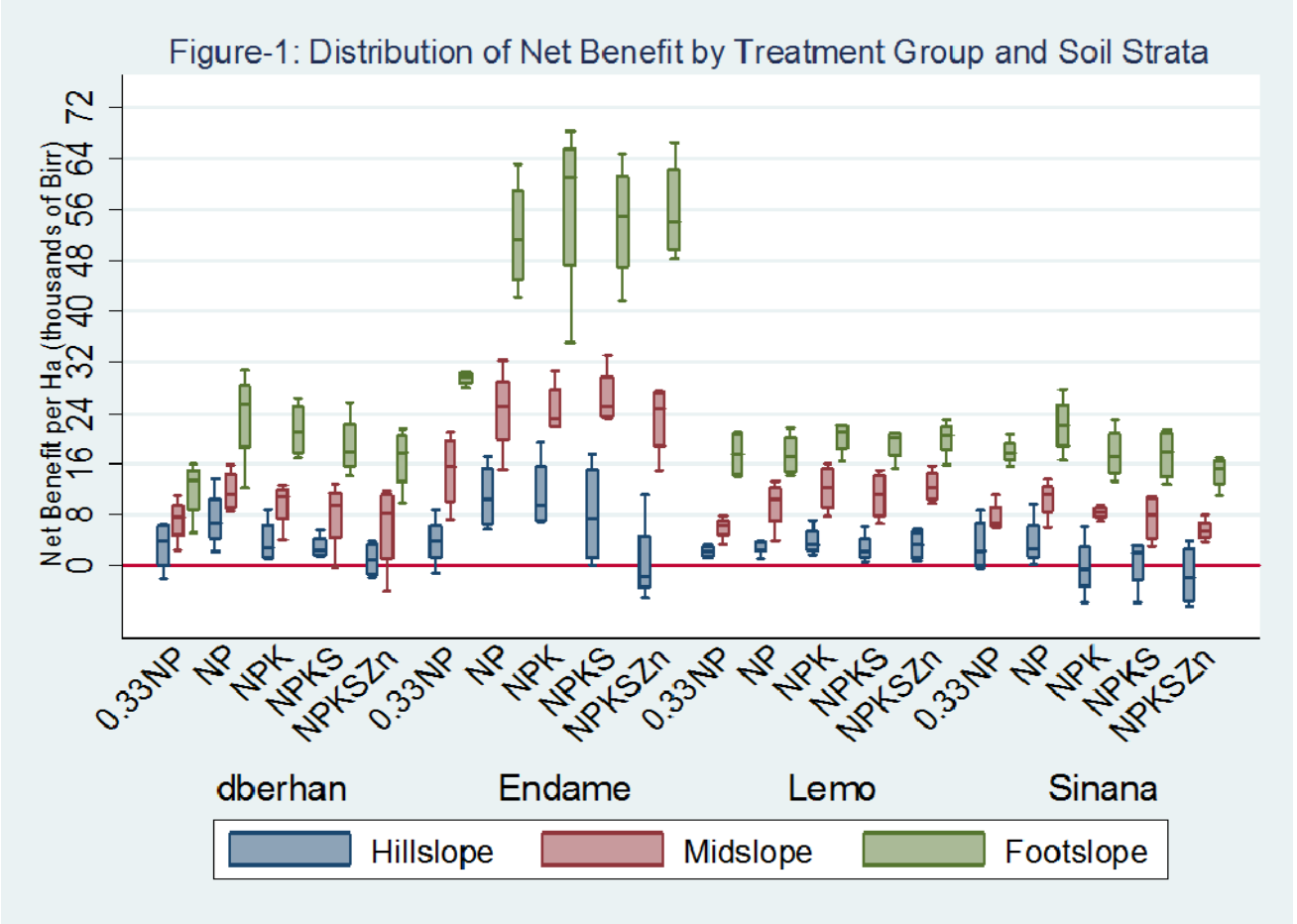
# Lemo Site

- **Foot slopes**: Very Good Crop and responded to fertilizer application;
- **Midslopes**: Crop is doing well and significantly responded to fertilizer application;
- **Mid/Hillslope:** Bad crop but the response to fertilizers is up to 200%

# Wheat Grain yield under various Landscape positions in Lemo

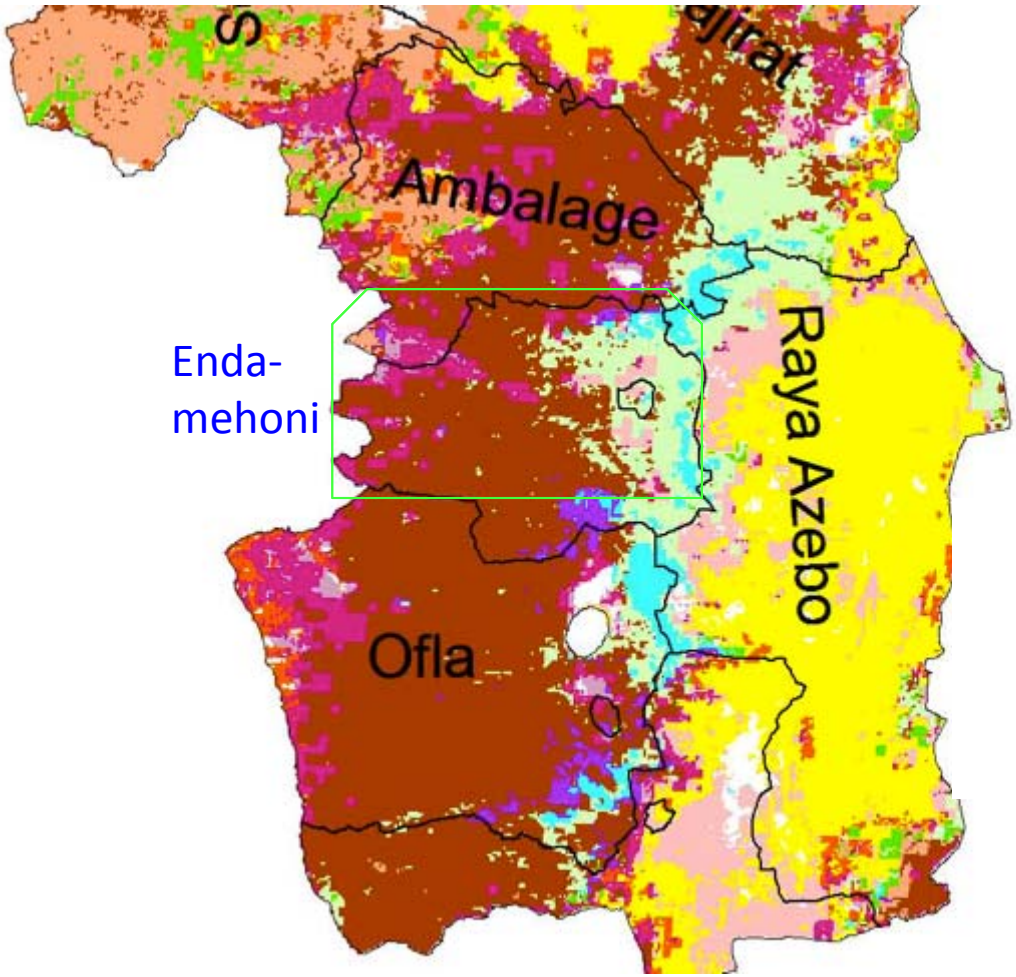


# Net benefits of input application



# Fertilizer recommendation for Southern Tigray:

## too fragmented, difficult to operationalize

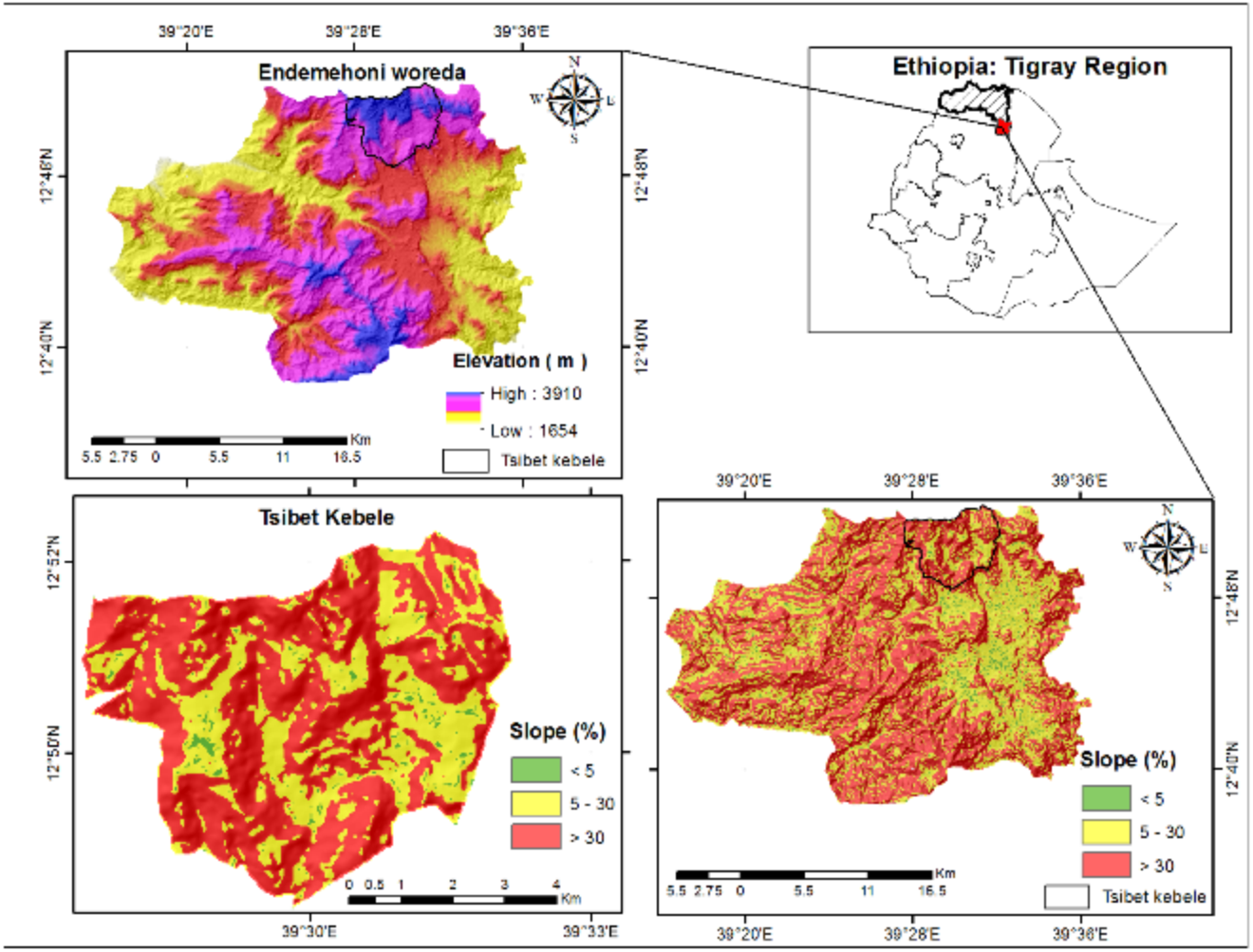



Enda-
mehoni

**Blended Fertilizer Types**

| | | |
|---|---|---|
| NPKS | NPKSZn | NPSFeZnB |
| NPKSB | NPKSZnB | NPSZn |
| NPKSFeZn | NPSB | NPSZnB |
| NPKSFeZnB | NPSFeZn | |

# District and Kebele DEM and Slope maps of Endamehoni



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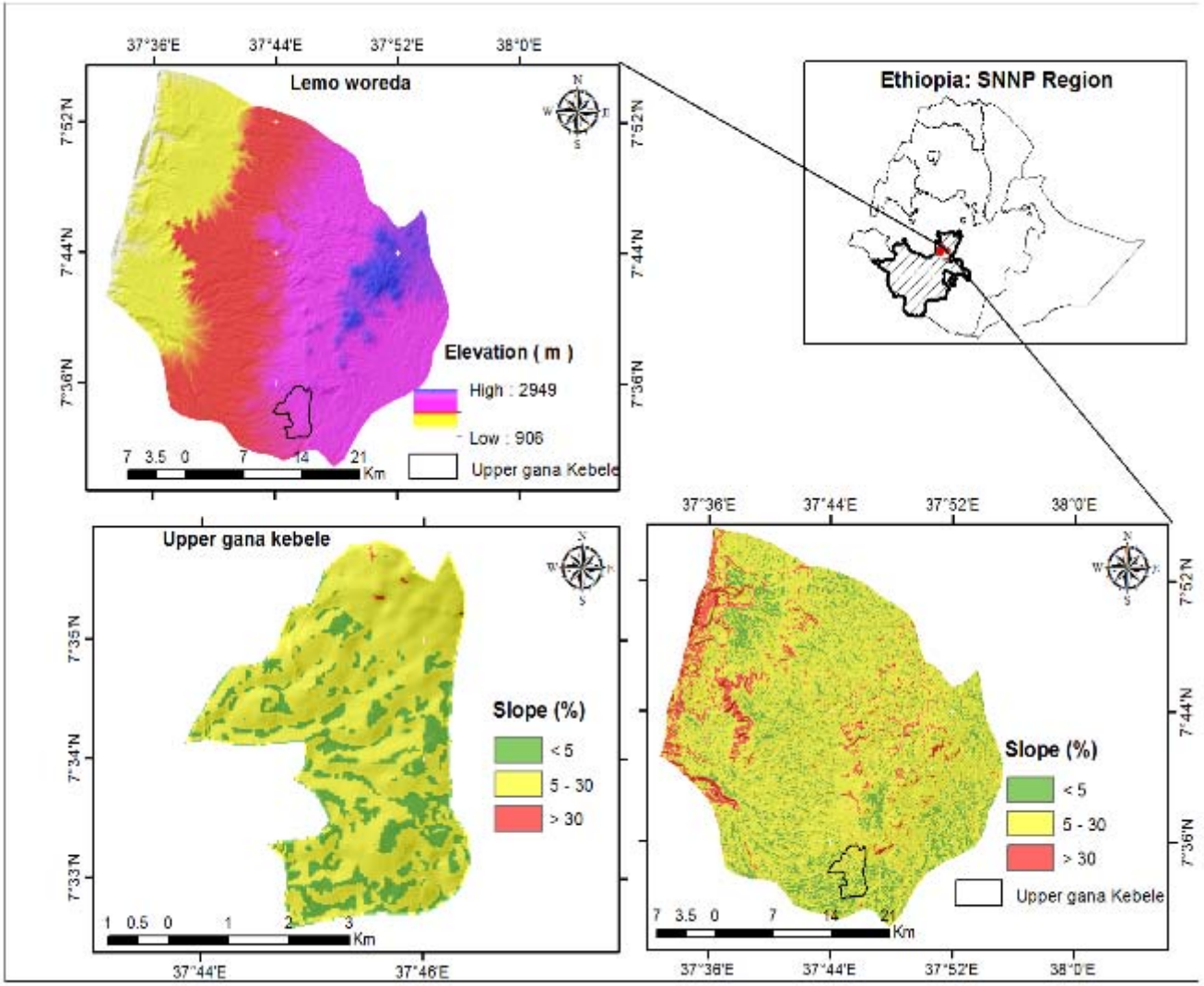
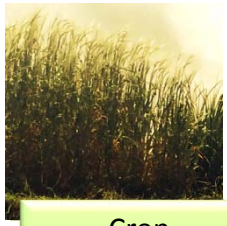


# Next steps

- **Validating our model** in other two major cropping systems (Maize/Teff based and Sorghum-based systems) in major regions; also with high value crops, with higher returns;
- **Institutionalization**: Assembling and re-analysing the available country wide ATA data, based on top-sequence/cropping system/soil types
- Through our national taskforce, and together with the ATA, EIAR and MoANR develop **Farmer friendly tool for efficient use of inputs,** country-wide
- Through Regional RARIs, Strengthen our Policy dialogue with the regions and lobby for change in approaches across the regions

# Fertilizer recommendation DST



Crop Requirement Information

Manure/ Compost Information

Land parcel location ( Map) and Cropping information

"Green Book" of National Crop & Soil Specific Nutrient Advice

Soil Nutrient Information

NMP Online

Farm Tabular Nutrient Recommendation /Report

Decision Support Tool Central Data System

Advisor – Farmer Consultation Information

Farm Nutrient Management Land Parcel Specific Fertiliser Plan

**Schulte etal, 2015**